POSITION SENSITIVE WIRE CHAMBER DEVELOPMENT FOR GEM DETECTOR

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The GEM detector at the Superconducting Super Collider (SSC) is one of the two large detector systems to be installed at the SSC Laboratory in Texas. GEM consists of three detector subsystems (Central Tracker, Calorimeter, and Muon System) located inside a 0.8-T superconducting solenoid magnet. The Central Tracker subsystem is composed of an inner silicon strip chamber and an outer Interpolating Pad Chamber (IPC)–a multiwire proportional chamber with cathode pad readout. This detector is a modification of a design which has been built and used at the Brookhaven National Laboratory.[1]

We have fabricated and tested a prototype IPC (shown in Fig. 1) which has the electrode dimensions of the proposed full size design. The prototype detector configuration is detailed in Table 1. A muon telescope composed of four prototype IPC's has been operated in the gap of an electromagnet at IUCF using prototype electronics and a fill gas which has been proposed for use in the full GEM IPC composed of approximately 60% CF_4 and 40% CO_2. Due to the small momenta of the highest energy particles available in the IUCF beam (and the resulting large multiple Coulomb scattering angles), we chose to operate the chambers using cosmic ray muons as the ionizing particles.

Data taken from these runs are being analyzed at the time of this writing. To date only the data taken with the magnetic field off have been analyzed. A histogram showing the single chamber position resolution of 46 μm is shown in Fig. 2. This graph was obtained by using the position in two chambers to point at a third chamber, and taking the difference between the predicted position (extrapolated from the first two chambers) and the actual position (as seen by the third chamber). Only events with projected (onto the high resolution plane) zenith angles of less than 2° are shown. A correction has been made for the pointing error of the first two chambers assuming that all three chambers have the same intrinsic resolution.

1. B. Yu, G.C. Smith, V. Radeka, and E. Mathieson, IEEE Trans. Nucl. Sci. **38**, 454 (1991).

TABLE I

Vital statistics for the configuration of the IPC prototype chambers.

Sensitive area	60 mm × 60 mm
Chamber thickness	4 mm
Anode wire pitch	2 mm
Anode-cathode separation	2 mm
Cathode inter-strip separation	75 μm
Cathode strip size	2.5 mm × 60 mm
Number of cathode pads	24
Anode wire	20 μm dia. Gold/Tungsten
Top (non-readout) cathode composition	70 nm Gold/50 μm Kapton
Bottom (readout) cathode composition	Au/18 μm Cu/0.5 mm G10
Chamber wall composition	G10

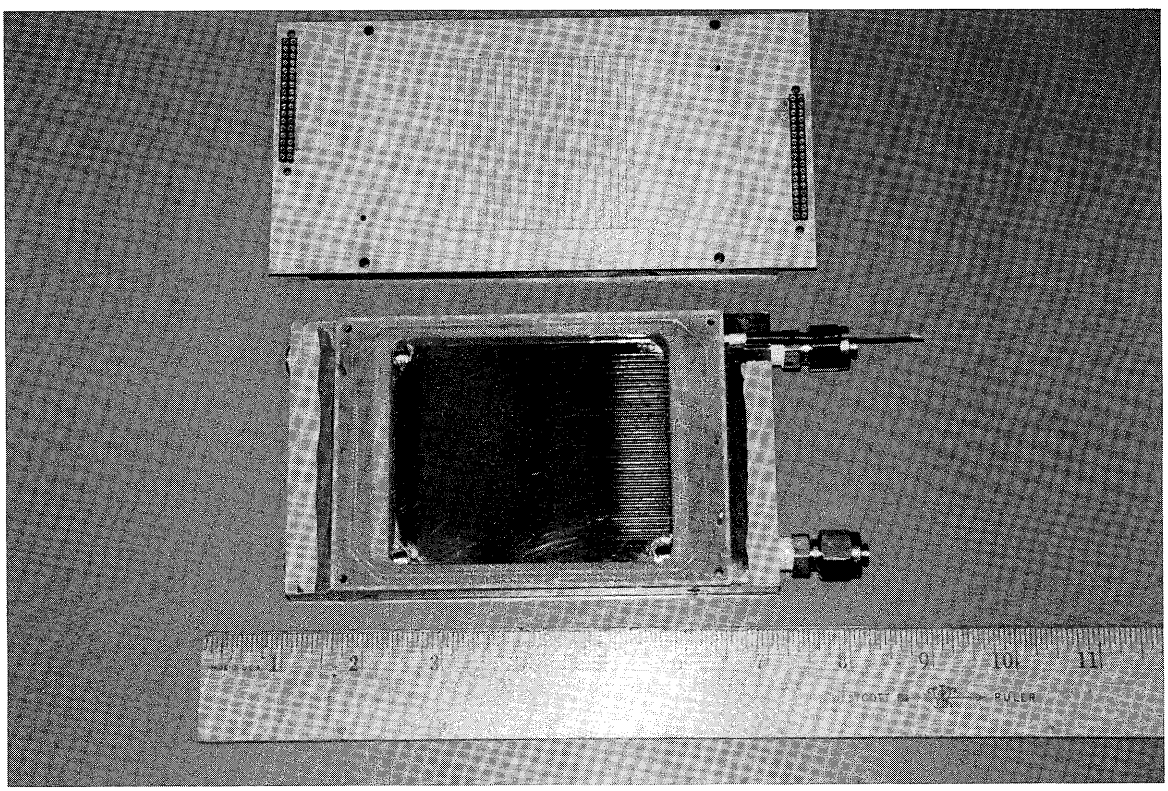

Figure 1. A photograph of the components of the prototype IPC.

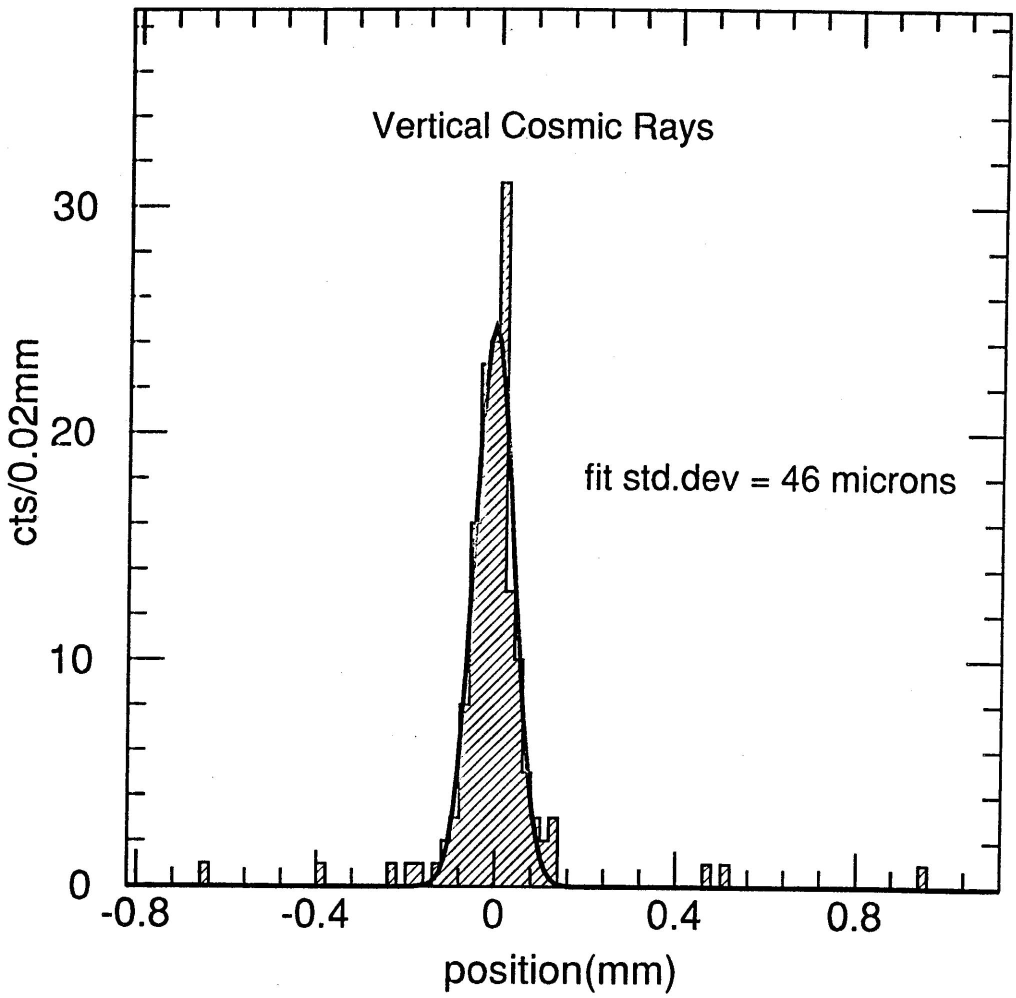

Figure 2. A histogram of the single chamber position resolution of one of the prototype IPC's. This histogram is built by taking the difference between predicted position (as determined by two independent chambers) and the measured position of a third chamber.